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Strategic groups in the Belgian fishing fleet

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ABSTRACT

This study examines the heterogeneity of the Belgian fishing fleet based on "strategic groups", a concept borrowed from the field of strategic management. Its objectives are: (1) to define strategic groups within the Belgian fishing fleet; (2) to examine the performance differences among these strategic groups; (3) to examine whether firms (i.e., vessels) move between strategic groups over time; and (4) to examine if firm-movement (i.e., vessel-movement) differs across strategic groups. In this study, strategic groups are derived through clustering firms based on their state of resources, built up through the collection of their past competitive strategic decisions, which are perceived as the main sources of mobility barriers (i.e. competitive advantages) in the fishing industry, namely: (1) technology, (2) product range and (3) geographic reach. Highly valid cluster solutions are obtained through use of excessive within- and between-method triangulation. Following this method, five strategic groups are identified that have distinct performance outcomes: (1) the large beam trawler fleet; (2) the small beam trawler fleet; (3) the shrimp beam trawler fleet; (4) the otter trawler fleet; and (5) the trammel netter fleet. Furthermore, in terms of firm movement and group loyalty, this study finds that once a vessel has decided on its strategic position in the fishing industry (i.e., the strategic group), in 80% of the cases, it stays in that position for a significant amount of time (in this case 10 years). However, not every strategic group enjoys this high level of group loyalty, since firm-movement differs significantly between the strategic groups. Although this is definitely a topic for further research, a possible interpretation for this phenomenon is the theory of "asymmetric mobility barriers" in combination with a firm's "isolating mechanisms". The value of this study lies in its practical relevance to both policymakers and ship owners. Strategic group theory gives insight into the strategic differences and the patterns of rivalry between firms within the same industry. Such insights are crucial when managing fisheries and could result in regulations which are more focused on (1) affecting strategic groups' competitive advantages (i.e., mobility barriers), (2) affecting "isolating mechanisms" of firms, and (3) managing rivalry between strategic groups. Ship owners and skippers can use the results of this study on the different performance potentials for the different competitive strategies in the current industry to determine if they are still satisfied with their current strategic direction. It allows them to reflect on current business and change strategic course based on the various performance indicators included in this research.

1. Introduction

The field of strategic management research aims to explain the differences in performance of firms (Gonzalez-Fidalgo and Ventura-Victoria, 2002; Rumelt et al., 1994; Short et al., 2007). As a result, the determinants of performance have long been of central interest to strategic management researchers. Their research has emphasised determinants at four primary levels of analysis: (1) firm; (2) strategic group; (3) industry; and (4) nation (Gonzalez-Fidalgo and Ventura-Victoria, 2002; Porter, 1998; Short et al., 2007). Research at the firm level focuses on how key within-organisation features shape outcomes. Perhaps the most popular perspective guiding this work is the resource-based view of the firm, which argues that a firm's bundle of resources and capabilities drive its performance (e.g., Barney, 1991, 1997; Wernerfelt, 1984, 1995). Strategic groups researchers argue that firms cluster around a limited array of competitive strategies that result in performance differences (e.g., Cool and Schendel, 1987; Fiegenbaum and

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Thomas, 1990; Hunt, 1972; Porter, 1979). Research at the industry or nation level examines the extent to which the industries (e.g., Bain, 1972; Mason, 1939; Rumelt, 1991) or the nations (e.g., Porter, 1998) where firms compete shape their performance. Although research has illustrated that each of these levels of analysis can explain a significant number of performance differences between firms (Gonzalez-Fidalgo and Ventura-Victoria, 2002; Porter, 1998; Short et al., 2007), this study examines the heterogeneity of the Belgian fishing fleet based on strategic group theory.

Strategic group theory defines strategic groups as “clusters of firms within an industry that have common specific assets and thus follow common strategies in setting key decision variables” (Oster, 1990: 61). Strategic group theory adopts mostly “a post-strategy position, offering a taxonomy of strategies employed by firms, where individual firms are classified into strategic groups through comparison of past strategic investments” (Leask and Parnell, 2005: 458). As a result, strategic groups are an analytical tool to examine differences in firm performance primarily based on a firm's “realised strategy” (Mintzberg, 1978). Only a few studies have defined strategic groups based on a firm's “intended strategy” (e.g., Dess and Davis, 1984; Fombrun and Zajac, 1987). Hence, strategic groups are “groupings” (Hatten and Hatten, 1987) instead of “groups” since they are used as an analytical tool to define intra-industry taxonomies.

In defining strategic groups, firms within an industry are clustered based on the homogeneity of their “past strategic investments”. These past strategic investments are primarily embodied in the state of the firm's “resource configuration” (Fiegenbaum et al., 1988: 8). Strategic investments are a collection of past competitive strategic decisions that attempted to make sure that a firm's resource configurations could not readily be “imitated by firms outside the group without substantial costs, significant elapsed time, or uncertainty about the outcome of those decisions” (McGee and Thomas, 1986: 150). Hence, the essence of group membership is that the state of resource configurations represent “mobility barriers” (Caves and Porter, 1977) which deter or inhibit the movement of a firm from one strategic group to another. As a result, Hatten and Hatten (1987) define a high mobility barrier as a competitive advantage on strategic group level, while low mobility barriers may be competitive disadvantages. Therefore, the defining characteristics of strategic groups arise from the source of their mobility barriers, i.e., a firm's resource configuration.

A distinct stream within empirical research has supported the notion of strategic groups. Central to these various studies have been one or more of the following research questions: (1) do strategic groups exist within industries; (2) does the existence of strategic groups affect overall industry performance; (3) does performance differ among strategic groups; and (4) do strategic group structures change over time? Viewed collectively, research has answered the first two questions positively (Cool and Schendel, 1988; Hatten and Schendel, 1977; Hatten et al., 1978; Hawes and Crittenden, 1984; Newman, 1978). However, research on the third question has produced conflicting evidence (Barney and Hoskisson, 1990; Cool and Schendel, 1988; Ketchen et al., 1997; Thomas and Venkatraman, 1988). Linkages between strategic group and firm performance have been identified in the following industries: brewing (Hatten and Schendel, 1977; Hatten et al., 1978), chemical processing (Newman, 1973, 1978), consumer goods (Porter, 1973), paints and allied products (Dess and Davis, 1984), industrial products (Hambrick, 1983), U.S. insurance (Fiegenbaum and Thomas, 1990), and retail mail-order (Parnell and Wright, 1993), among others. However, these linkages were often equivocal since some studies only used one performance indicator (e.g., Hatten et al., 1978) and others have used multiple indicators but fail to find rigorous linkages between strategic groups and all of their performance indicators (e.g., Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990; Katobe and Duhan, 1993). Finally, research addressing the last question mainly agrees that strategic groups are “stable” over time (Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990; Oster, 1982).

The objectives of this study are in line with these central questions in strategic group research. The objectives are: (1) to define strategic groups within the Belgian fishing fleet; (2) to examine the performance differences among these strategic groups; (3) to examine if firms (i.e., vessels) move between strategic groups over time; and (4) to examine if firm-movement (i.e., vessel-movement) differs across strategic groups. These objectives are then translated into the following four null hypotheses:

$H0_1$. All vessels belong to the same strategic group.

$H0_2$. All strategic groups perform the same.

$H0_3$. Vessels do not move among strategic groups over time.

$H0_4$. Each strategic group encounters equal firm movement.

Testing these hypotheses begins, in Section 2 with a brief description of already existing taxonomies and classifications in Belgian fisheries, illustrating their shortcomings and why they differ from the strategic group concept. Next, the methodology is described to define strategic groups within the Belgian fishing fleet. Central to this methodology is the determination of the dominant sources of mobility barriers within the Belgian fishing fleet (i.e. key resources of vessels) and the use of a two-stage clustering procedure (i.e. a hierarchical clustering followed by a non-hierarchical clustering) based on these obtained resources to arrive at the strategic groups. In addition, the methods used to enhance the external- and criterion-related validity of the cluster solutions are explained. The section ends with a discussion on the statistical tests used to examine the performance differences across the strategic groups and the methods used to measure changes in group membership. Section 3 presents the results, starting with the definition of five strategic groups within the Belgian fishing fleet, each having distinct strategies related to the earlier defined key resources of vessels of the Belgian fishing fleet. Last, the results about the performance differences and firm-movement across these strategic groups are given. Section 4 discusses the results in the light of strategic group research. It also discusses the limitations of the study and highlights the value of strategic groups in improving fisheries management.

2. Materials and methods

2.1. Existing taxonomies and classifications

Although the Belgian fishing fleet may seem homogenous at first glance, important distinctions between fishing methods and sub fleets are made using different taxonomies or classifications that serve as frameworks for data collection, regulation or reporting. Following FAO's (1999) technical paper on “Definition and classification of fishing gear categories”, the Belgian fleet can be subdivided by fishing method. This classification of fishing methods is a commonly accepted and comprehensive classification of all fishing methods around the world. Next, the Belgian fleet can also be divided into sub fleets corresponding to European legislation (EC, 2002). EU regulation aggregates vessels in fleet segments mainly based on technological characteristics (i.e., fishing methods, gear characteristics and mesh size). The EU also reports yearly economic performance indicators per sub fleet. In these reports (e.g., EC, 2003, 2004), three sub fleets are identified: (1) beam trawlers over 24 m, (2) beam trawlers under 24 m, and (3) shrimp beam trawlers. Belgian policymakers also use different sub fleet classifications in reporting yearly key figures of the state of Belgian

Table 1
Operational definitions and unit of measurement of the resources perceived by fisheries scientists as being the sources of mobility barriers between strategic groups in the Belgian fishing fleet.

Resources	Operational definition	Unit of measurement
Technology	(1) Percentage of hours beam trawling (the dominant active fishing method in Belgian fisheries) in total number of fishing hours per year	Percentage (%)
	(2) Percentage of hours trammel netting (the dominant passive fishing method in Belgian fisheries) in total number of fishing hours per year	Percentage (%)
Product range	Number of species landed per trip	# Species
Geographic reach	Engine power	kW
Modernisation level	The age of the vessel	Years
Product quality	Trip duration in number of hours a vessel spent at sea per trip	# Hours
Markets	Number of auctions visited in a year	# Auctions

fisheries over the last decade. In one type of reports (e.g., Tessens and Velghe, 2004a, 2005a, 2006a), they distinguish (1) coastal fishers, (2) eurocutters, (3) large beam trawlers, (4) other small fleet segment, and (5) other large fleet segment. In another type (e.g., Tessens and Velghe, 2004b, 2005b, 2006b), they report key figures based on what they refer to as "fisheries": (1) Otter trawling, (2) Shrimp fishery, (3) Beam trawling, (4) Nephrops fishery, and (5) Others. Finally, at the European level, there is now the emergence of a new approach to fleet classification in fisheries. Instead of classifying vessels in fleet segments, they now start to classify fishing trips in métiers. These métiers should "reflect the fishing intention, e.g. the species targeted, the area visited, and the gear used, at the start of a fishing trip" (Marchal, 2008: 674). Following this métier approach, a vessel can now be assigned to more then one class (i.e., métier) during a certain time frame. However, each of these classifications has one or more shortcomings, for instance: (1) the classification is overly complex; (2) the classification only uses one type of "clustering variable"; (3) the classification contains more than one leftover category (i.e., "others"); (4) the classification is not exhaustive; or (5) the classification is based on intention which can differ significantly from actual behaviour. As a result, despite the validity of all of these taxonomies, they have not emerged from a strategic approach and thus do not satisfy the definition and conditions of strategic groups. Additionally, the clustering method of strategic groups proposed in this paper has the potential of providing a solution to these abovementioned problems provided the link between clusters and fisheries externalities or market failures can be established.

2.2. Defining the dominant resources that are the source of mobility barriers within the Belgian fishing fleet

Strategic groups' defining characteristics arise from the source of their mobility barriers. McGee and Thomas (1986) identify three sources of mobility barriers: (1) the state of market-related resources, (2) the state of production and logistics resources, and (3) the state of infrastructure and corporate resources. However, the literature has still not agreed on how to start actually choosing the most relevant or dominant resources within these sources of mobility barriers. As a result, a variety of methods have been used to derive groupings in empirical research settings, resulting in a non-uniform approach and choice of resources (Fiegenbaum et al., 1988; Ketchen and Shook, 1996; McGee and Thomas, 1986; Short et al., 2007; Thomas and Venkatraman, 1988). Thomas and Venkatraman (1988: 539) state that "some researchers specify the characteristics of the groups *a priori*, based on extant theoretical rationale, and subsequently employ data-analytic techniques to validate or invalidate their theoretical groupings. In contrast, others derive the grouping structure *a posteriori* based on empirical results on a specific data set."

This study specifies the defining resources of the strategic groups *a priori* based on a triangulation of methods, as suggested by Ketchen and Shook (1996). First, a "cognitive approach" (Ketchen and Shook, 1996) is used to generate a first list of relevant resources. This is done through four in-depth interviews with fisheries scientists of the Institute for Agricultural and Fisheries Research (ILVO), where the interviews continued as long as they contributed new resources to the list. The outcome of these in-depth interviews was a list of eight resources which were perceived as the sources of mobility barriers between strategic groups in the Belgian fishing fleet. These eight resources are: (1) technology, (2) product range, (3) geographic reach, (4) fishermen's skill, (5) modernity level, (6) product quality, (7) markets, and (8) crew. Although fishermen's skill and crew were also perceived as very important, we did not include them in our further analysis as information could hardly be obtained on education, fishing experience and number of persons on board the vessels when fishing.

"Technology" captures the difference in fishing methods a vessel uses to catch fish. Although the dominant fishing method in the Belgian fleet is beam trawling, they also use otter trawling and trammel netting. Technology is perceived as a very important discriminator between vessels since it reflects a fishermen's choice between active fishing (i.e., beam trawling and otter trawling) and passive fishing (i.e., trammel netting). The distinction between active and passive fishing methods is currently very important given high fuel prices at the time of our dataset. "Product range" in fisheries is defined in this study as the landing compositions. It captures the difference between mixed fisheries and specialisation towards catching target species. "Geographic reach" captures how far offshore a vessel can go fishing. This is mainly determined by technical characteristics like engine power, tonnage and vessel length. "Modernity level" describes the state of the vessel: new versus old. "Product quality" captures the state of the landed fish, which is mainly a function of its treatment on board and the time between catching and selling. Finally, "Markets" stands for the number of auctions a vessel uses to sell its fish.

In a second step, a meeting was held with the four previously interviewed fisheries scientists in a quest to identify, mainly based on theoretical rationale (i.e., a "deductive approach" (Ketchen and Shook, 1996)), the actual dominant sources of high mobility barriers between strategic groups in the Belgian fishing fleet. This choice was guided by (1) the list of eight resources that had emerged from the in-depth interviews, (2) their combined knowledge about the Belgian fishing fleet, (3) lessons learned from the existing taxonomies in Belgian fisheries, (4) the measurability of the resources, (5) data availability through past monitoring of the resources, (6) the literature on strategic groups (e.g., McGee, 1985; McGee and Segal-Horn, 1990; McGee and Thomas, 1986; Thomas and Venkatraman, 1988); and (7) more specifically, the three sources of mobility barriers defined by McGee and Thomas (1986). The decision was made to pick for each of the three sources of mobility barriers defined by McGee and Thomas (1986) the dominant one. This choice was based on discussion. A first step in this process was taken by agreeing on the operational definitions and unit of measurement for all six resources (see Table 1). In addition, Table 1 also shows how "Technology" is measured by two operational definitions reflecting the different dimensions of "Technology" (i.e. opposite choices). A second step was to decide source-by-source what the dominant resource is for each of the three theorized sources of mobility barriers by McGee and Thomas (1986). "Technology" was chosen as the dominant production resource since the fishing method a vessel operates was perceived as the most significant part of the production process. Additionally, it also has an effect on "Product quality" because the quality of the landed fish is also a function of the used method to catch the fish next to other processing variables like its treatment on board and the time between being caught, iced and sold. "Product range" was chosen as the dominant market-related resource since it captures the important strategic decisions and skills on targeting and landing the desired range of species. It is the result of being able to (1) effectively target the range of species you want to catch (optimally at the lowest costs), and (2) choose based on the effective catches which species to land and which to discard (all previous decisions are of course related to market and regulatory conditions). Hence, it was perceived by the fisheries scientists that this resource of "product range" is therefore more important than the resource "Markets". Especially given the fact that Belgian fishermen do not land their fish on many different markets (i.e., 89% of the fish caught by Belgian vessels in 2006 was landed in the three Belgian fish auctions). Finally, "Geographic reach" was chosen as the dominant infrastructure-related resource instead of the resource "Modernity level". The underlying reason is that the geographic reach of a vessel is very important within the Belgian context where different quota are allocated to different fishing ground. Additionally, modernity level is also a resource which differentiates more between vessels of the same strategic group instead of across strategic groups. In sum, this meeting concluded that the competitive advantage of sub fleets mainly lies within the configuration of the following three resources: (1) technology, (2) product range, and (3) geographic reach. These are: the dominant production resource, the dominant market-related resource and the dominant infrastructure-related resource, respectively. As a result, these three resources create the strategic dimensions (or axes) of the "strategic space" (Edgar et al., 1994; Fiegenbaum and Thomas, 1990; McGee and Segal-Horn, 1990) in which vessels position themselves by means of the state of their resource configuration.

2.3. *Defining strategic groups in the Belgian fishing fleet*

Having defined the three main resources that are perceived as the source of mobility barriers in the Belgian fishing fleet, they will now serve as the cluster variables in the analysis to group vessels with the same state in resource configurations. Data on the state of these three resource configurations are collected for all Belgian vessels (i.e. census) between 1997 and 2006 and are stored in "Belsamp", a database hosted at the Fisheries Biology Section of ILVO-Fisheries. Before clustering however, the cluster variables are tested for multicollinearity among the variables through Pearson's r correlation coefficient and Haitovsky's χ^2_H (Haitovsky, 1969). In applying the clustering, the suggestions made by Ketchen and Shook (1996) on the application of cluster analysis in strategic management research were taken into account. They believe that the key to overcoming the problems and critiques related to cluster analysis (i.e., cluster analysis' reliance on researcher judgement) is the vigorous pursuit of both within-method and between-methods triangulation. As a result, this study starts with applying a two-stage clustering procedure[4] where a hierarchical algorithm is used to define the number of strategic groups and cluster centroids. These results serve next as the starting point for subsequent non-hierarchical clustering (Hair et al., 1998; Ketchen and Shook, 1996). Research has shown that this two-stage procedure increases validity of solutions (Ketchen and Shook, 1996; Milligan, 1980; Punj and Stewart David, 1983). Afterwards, the obtained cluster solutions of the non-hierarchical clustering are tested for significant differences between the cluster means through Kruskal–Wallis tests and Mann–Whitney U post hoc tests both with Bonferroni adjustment ($\alpha' = 0.005$ since $k = 5$ where k equals the number of strategic groups). The outcome of these non-parametric tests will allow us to meet our first objective and hypothesis.

The hierarchical clustering uses Ward's method (i.e., clusters are generated that minimize the squared Euclidean distance to the centre mean) (Ward, 1963) on the standardised individual vessel data (i.e., z-scores) for each cluster variable over the years 1997–2006 (pooling of each vessel-year combination in one dataset on which the clustering is run). This approach assumes that the environment is stationary over time; an assumption which is reasonable given its 10-year timeframe. Ward's method is best suited for this study since (1) it is the method which focuses the most on homogeneity within groups by minimising their within-cluster sum of squares (Hair et al., 1998), and (2) its main disadvantage, namely its sensitivity to outliers (Ketchen and Shook, 1996), is eliminated since our dataset – a census – has no outliers. In addition, Ward's method was also commonly used in earlier studies clustering strategic groups (e.g., Fombrun and Zajac, 1987; Gonzalez-Fidalgo and Ventura-Victoria, 2002). To determine the optimal number of clusters, the first largest percentage change in the agglomeration coefficient will be used (Hair et al., 1998). Validation of the outcome of this rule occurs through visual inspection of the dendogram and *a priori* theoretical rationale (i.e., the existing taxonomies of the Belgian fishing fleet). The non-hierarchical clustering is a k-means clustering based on the cluster results of the hierarchical clustering. It is again, as the hierarchical clustering, one clustering across the entire dataset of pooled vessel-year combinations.

2.4. *Determining the validity of the strategic groups*

Further, this study needs to validate the obtained cluster solutions. Ketchen et al. (1996: 447) state "the goals of validation are to ensure that a cluster solution has external validity (i.e., is representative of the general population of interest) and criterion-related validity (i.e., is useful for the prediction of important outcomes)". To verify the external validity of the cluster results, this study only needs to focus its effort on illustrating the reliability of the cluster solution (a necessary condition of validity) because the dataset is a census of the general population of interest. The reliability of the cluster solution is verified through triangulation. For the hierarchical clustering, the within-method triangulation consists of applying multiple clustering algorithms (i.e. single linkage, average linkage and centroid method) to confirm the results given by Ward's method. In addition, this study also used multiple methods to determine the optimal number of clusters within the use of Ward's method. For the non-hierarchical clustering, the within-method triangulation consists of running the k-means clustering multiple times with random clustering centroids instead of those given by the hierarchical clustering. In addition, the k-means clustering results were also compared with its non-parametric equivalent (i.e., k-mediods – PAM) which partitions around the mediods instead of the means. Finally, discriminant analysis is used to determine how well the vessels were classified into the right strategic groups, since "the aim of this technique is to predict the membership of an individual (*the vessel*) to a qualitative group defined beforehand (*strategic groups*)" (Rason et al., 2007: 520). For this, discriminant analysis bases its "judgement" (i.e. how well the vessels were clas-

[4] All the equations and algorithms used in this paper for clustering can be found at: http://support.spss.com/ProductsExt/SPSS/Documentation/Statistics/algorithms/14.0/cluster.pdf.

Table 2
Testing the multicollinearity among the selected cluster variables (Pearson's *r* correlation coefficient), 1997–2006.

		Technology		Product range	Geographic reach
		% Beam trawling	% Trammel netting	# Species/trip	kW
Technology	% Beam trawling	1.00	−0.45**	0.19**	0.26**
	% Trammel netting		1.00	−0.19**	−0.05
Product range	# Species/trip			1.00	0.68**
Geographic reach	kW				1.00

** Correlation is significant at the 0.01 level (two-tailed).

sified into the right strategic groups) on the discriminant function, a linear combination of the cluster variables used originally to cluster the strategic groups, that discriminate most between these strategic groups. This is a form of between-method triangulation. An idea we borrowed from other fields like market research (Rason et al., 2007) and geography (Power and Campbell, 1992).

Criterion-related validity can be accessed through significance tests on external variables which are theoretically related to the cluster but not used in defining the clusters (Ketchen and Shook, 1996). Given our second hypothesis ("all strategic groups perform the same"), performance indicators are the obvious choice for external variables. Since performance consists of many "dimensions", this study will look at (1) operational and (2) financial measures, and (3) measures of overall effectiveness (Venkatraman and Ramanujam, 1986). The operational dimension of performance is measured through (1) the average landings of a vessel (kg mixed fish), and (2) the average landings of a vessel per fishing hour (kg mixed fish/fishing hour). Here, financial performance measures (all expressed in nominal values) are accounting profits and are mainly based on the average gross operating profit (GOP = Total Revenues (TR) − Total Operating Costs (TOC), where TOC = Labour Costs + Unload & Sales Costs + Insurance Costs + Maintenance Costs + Fishing Gear Costs + Gas & Fuel Costs + Rental Costs of Board Equipment + Other Costs) of a vessel, starting with its value (i.e., GOP) followed by two relative measures: (1) the average gross operating profit of a vessel per fishing hour (GOP/fishing hour), and (2) the average gross operating profit of a vessel per kilogram of mixed fish landed (GOP/kg fish). Additionally, the values of net operating profit (NOP = GOP − Depreciations + Financial Result (FR), where FR = Financial Yield[5] − Financial Costs[6]) are also given to illustrate the effect of the capital costs on the firm's financial performance. Finally, the measure of overall effectiveness is the average rate of return on investment (ROI = NOP/Estimated Capital Investment), which indicates the profitability of the investment in relation to other alternative investments (Tietze et al., 2005).

Data on the operational performance indicators are collected for all Belgian vessels between 1997 and 2006 (i.e. a census) and can be retrieved from the "Belsamp"-database. Data on the financial measures and the measure of overall effectiveness are stored at the Belgian Sea Fishery Service of the Flemish government. They collect accounting data on individual vessel level for the Belgian fishing fleet through annual surveys. These surveys are taken on a voluntary basis and they sample on average 50% of the fleet (i.e., approximately 60 vessels) between 1997 and 2006. However, not all strategic groups are sufficiently present each year. Additional data was collected by the authors through the annual accounts of fishing firms, resulting in sufficiently high sample sizes for each strategic group per year. Finally, data related to investments and depreciation periods were collected and confirmed by previous studies (e.g., Thøgersen et al., 2009; Tietze et al., 2005; Van Craeynest, 2008).

Significant differences among strategic groups on these performance measures are tested through Kruskal–Wallis tests (Cool and Schendel, 1988) in combination with Mann–Whitney *U* tests as post hoc test both with Bonferroni adjustment ($\alpha' = 0.005$ since $k = 5$ where k equals the number of strategic groups). Consequently, the outcome of these tests will formulate an answer to the second hypothesis of this study.

2.5. Determining firm-movement across strategic groups

In order to test the third and fourth hypothesis on firm movement (vessel movement) across strategic groups, this study defines firm movement as "cluster analytic assignment of a firm to a different group than it had been in during the prior year" (Mascarenhas, 1989: 346). Consequently, in order to calculate firm movement rates between strategic groups, the yearly membership of each vessel was noted. Then, the number of vessels moving from one strategic group to another and the number of vessels remaining in the same strategic group in adjacent years are recorded. As a result, the firm movement rates are based on simple counts and percentages.

3. Results

3.1. The strategic groups of the Belgian fishing fleet

The three resources (i.e., technology, product range and geographic reach), which are perceived as the competitive advantage at the level of sub fleets, serve as the cluster variables in a two-stage clustering procedure in determining strategic groups in the Belgian fishing feet. However, before clustering, the cluster variables are tested for multicollinearity through Pearson's *r* correlation coefficients. Significant coefficients above the commonly agreed 0.80 illustrate severe multicollinearity between variables (Field, 2009). However, Table 2 indicates that this is not the case since there is only some correlation between product range and geographic reach ($r = .68$, $p < .01$). Additionally, Haitovsky's χ^2_H is highly significant ($\chi^2_H(6) = 631.66$, $p < .01$) which confirms that these cluster variables do not suffer severely from multicollinearity (Haitovsky, 1969).

Next, a hierarchical clustering (Ward's method–Euclidean distance) is performed to define the number of strategic groups and cluster centroids which will later be used as a starting point for subsequent non-hierarchical clustering. Determining the optimal number of clusters necessitates a trade-off between fewer clusters on the one hand versus more homogeneity on the other. The most basic structure must be found that still achieves the necessary level of similarity within the clusters (Hair et al., 1998: 476). To make this trade-off, the first large percentage change in the agglomera-

[5] *Financial yield* equals "direct subsidies" (Tessens and Velghe, 2008) as defined in the Annex VI of the Commission Decision of 6 November 2008 (2008/949/EC). It includes "direct payments, e.g. compensation for stopping fishing, refunds of fuel duty or similar lump sum compensation payments. Excludes social benefit payments, indirect subsidies, e.g. reduced duty on inputs such as fuel, investment subsidies" (EC, 2008).

[6] *Financial costs* are defined as in Tessens and Velghe (2008) and are the interests on outstanding debts related to the fishing vessel.

Table 3
Agglomeration coefficient for the hierarchical cluster analysis, 1997–2006. (Bold = First sudden jump in agglomeration coefficent).

# Clusters	Agglomeration coefficient	% Change in coefficient to next level
10	341.86	9.92
9	379.52	10.01
8	421.74	15.27
7	497.75	14.13
6	579.66	19.47
5	719.79	**30.93**
4	1042.12	40.99
3	1766.07	46.07
2	3275.04	38.35
1	5312	–

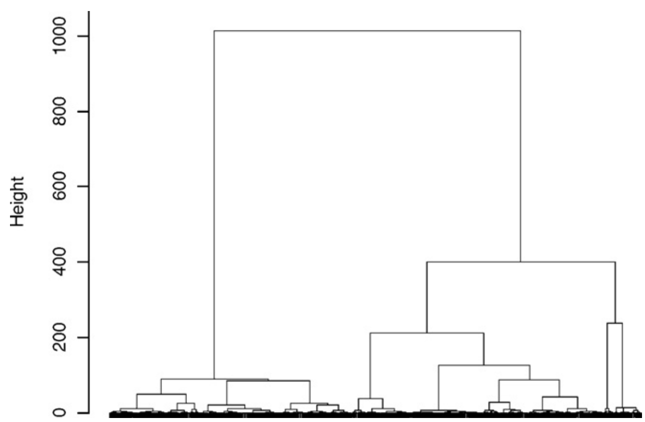

Fig. 1. Dendogram of the hierarchical clustering using Ward's method and Euclidean distance, 1997–2006.

tion coefficient in the hierarchical clustering is examined. Table 3 illustrates the percentage change in agglomeration coefficient for the 10 final aggregations between clusters. This table clearly shows that the aggregation step between five and four clusters is accompanied by a first sudden jump in percent change in aggregation coefficient (approximately 31%; indicated in bold in Table 3). In addition, visual inspection of the dendogram (Fig. 1) also confirms the choice of five clusters as a suitable number of clusters, although this method leaves more room for alternative interpretations (e.g., the use of only three clusters). Furthermore, the use of five clusters does not flatly oppose to *a priori* theoretical rationale since Belgian policymakers also use five sub fleets in reporting key figures of the Belgian fishing fleet.

Finally, although the hierarchical clustering was based on Ward's method, other clustering algorithms were also used to increase the reliability of the cluster solution (i.e., within-method triangulation). Although some cluster methods suggested quite different results (e.g., "Single Linkage Method", that clusters objects based on the minimum distance between them, recommends two groups), others came fairly close to the suggested outcome of Ward's method. "Average Linkage" (that clusters objects based on the average distance between all pairs of objects) and the "Centroid Method" (which generates clusters that maximize the distance between the centres of clusters) can both agree with the number of clusters ranging between three to six. Consequently, the obtained cluster centroids for five clusters will serve as the initial cluster centroids for the subsequent non-hierarchical clustering.

Table 4 presents the non-standardised cluster means and the number of cases per cluster resulting from the non-hierarchical clustering. In addition, it also summarises which cluster means are significantly different from each other. Based on these results, this study labels[7] the first cluster as the "large beam trawler fleet". These vessels have high-powered engines (on average, 855.32 kW), which allow them to cover all of the Belgian fishing grounds. They usually operate the beam trawl (i.e., an active fishing method) as their only fishing method (98.51% of their fishing time) and they land the highest variety of species (average 19 species). A second cluster is labelled as the fleet of "small beam trawlers". They mainly differ from the large beam trawlers because of lower engine power (on average, 256.43 kW) and slightly less diverse landings (average 15 species). A third cluster is labelled the "shrimp beam trawler fleet". They differ from the small beam trawlers because their landing composition is quite specialised (average 5 species per trip; around 25% of the total landed weight is brown shrimp) and their engine is on average slightly less powerful (on average, 201 kW). However, since some small beam trawlers seasonally target shrimps and therefore temporarily behave as shrimp trawlers, the distinction between the small beam trawler fleet and the shrimp trawler fleet is slightly sensitive. A fourth cluster is labelled as the "otter trawler fleet". They are similar to the small beam trawler fleet but differ in fishing method. However, both are active fishing methods. Additionally, otter trawlers also have a slightly less diverse product range (an average of 12.43 species per trip). Finally, a fleet exists that uses passive fishing methods (on average, 93% of the fishing time is spent on trammel netting). This sub fleet is labelled as the "trammel netters". These vessels have engine powers of 319 kW on average, which is higher than most small beam trawlers, shrimp beam trawlers and otter trawlers, but lower than the large beam trawlers. They are specialised in just a few species (an average of 4 species per trip), comparable with the shrimp beam trawlers. However, further inquiry into the data unveils that these vessels do not target shrimp.

To validate this final cluster solution, the within-method triangulation consists of running the *k*-means clustering multiple times with random clustering centroids instead of those given by the hierarchical clustering. These runs gave mostly the same or similar cluster results. In addition, the *k*-means clustering results were also compared with its non-parametric equivalent which partitions around the mediods instead of the means (*k*-mediods – PAM). The results of this clustering confirm the obtained results of the *k*-means clustering, which increases its reliability. Finally, discriminant analysis is used to "judge" how well the vessels were classified into the right strategic groups based on the discriminant functions (i.e. linear combination of the dominant sources of mobility barriers in the Belgian fishing fleet: technology, product range and geographic reach) that discriminate most between these strategic groups. The most important output of the discriminant analysis for this study is Table 5 often referred to as the "classification table" or "confusion table" in which the rows are the observed categories of the dependent variable and the column are the predicted categories. The percentage of cases on the diagonal is the percentage of correct classifications. The cross validation is often termed a 'jackknife' classification since it successively classifies all cases but one to develop the discriminant function and then categorizes the case that was left out. This process is repeated with each case left out in turn. This cross validation produces a more reliable function. The argument behind it is that one should not use the case you are trying to predict as part of the categorization process. With 99.2% of original grouped cases and 99% of cross-validated grouped cases correctly classified (see "b" and "c" under need the table in

[7] The subjective cluster labels of the strategic groups will be used directly throughout this paper to refer to the five different clusters. They should not be interpreted in the same way as similarly labelled fleet segments from "classic" fleet taxonomies since they are cluster solutions with imperfect classification of vessels.

Table 4
Number of cases per cluster and the cluster means for the non-hierarchical *k*-means clustering (mean), 1997–2006.

	Cluster	1	2	3	4	5
	Cluster labels	Large beam trawlers	Small beam trawlers	Shrimp beam trawlers	Otter trawlers	Trammel netters
	N	573	265	379	86	26
Technology	% Beam trawling	98.51[c]	93.20[b]	92.15[b]	8.99[a]	4.10[a]
	% Trammel netting	0.00[a]	0.00[a]	0.04[a]	0.26[a]	93.46[b]
Product range	# Species/trip	18.58[d]	15.29[c]	4.67[a]	12.43[b]	4.23[a]
Geographic reach	kW	855.32[e]	256.43[b]	200.72[a]	300.67[c]	380.96[d]

Different superscripts (a–e) indicate significantly different average means using Kruskal–Wallis and Mann–Whitney *U* as post hoc test both with Bonferroni adjustment ($\alpha' = 0.005$ since $k = 5$).

Table 5
Cross table comparing the classification results of the *k*-means clustering with those of the discriminant analysis (%), 1997–2006.

		Classification results[b,c]				
		Predicted group membership (discriminant analysis)				
		Small beam trawlers	Otter trawlers	Large beam trawlers	Trammel netters	Shrimp beam trawlers
Original (cluster analysis)	Small beam trawlers	99.2	0	0	0	0.8
	Otter trawlers	0	98.8	1.2	0	0
	Large beam trawlers	1	0	99	0	0
	Trammel netters	0	0	0	100	0
	Shrimp beam trawlers	0.5	0	0	0	99.5
Cross-validated[a]	Small beam trawlers	99.2	0	0	0	0.8
	Otter trawlers	0	97.7	1.2	0	1.2
	Large beam trawlers	1.2	0	98.8	0	0
	Trammel netters	0	0	0	100	0
	Shrimp beam trawlers	0.5	0	0	0	99.5

[a] The cross validation successively classifies all cases but one to develop a discriminant function and then categorizes the case that was left out.
[b] **99.2%** of original grouped cases correctly classified.
[c] **99.0%** of cross-validated grouped cases correctly classified.

bold), this discriminant analysis forms an additional verification of the reliability of the cluster solutions gained by the *k*-means clustering.

3.2. Performance among the strategic groups of the Belgian fishing fleet

Having defined five strategic groups in the Belgian fishing fleet, this study now examines whether the performance differs across these groups. Table 6 presents the averages of the different performance measures between the years 1997 and 2006 for each strategic group. In addition, it also summarises which averages are significantly different from each other. Landings (kg mixed fish) and GOP (current €) show that shrimp beam trawlers and trammel netters (i.e., two specialised fisheries) have both limited landings (mean yearly landings of 76,244 and 44,558 kg mixed fish, respectively), resulting in low gross operating profit (55,642 euro and 61,469 euro on average, respectively). Otter trawlers and small beam trawlers have equally high GOPs and perform, without taking into account the costs of capital, better than shrimp beam trawlers and trammel netters. They have average yearly landings of approximately 150 tonnes mixed fish and GOP of roughly 100,000 euro. Both are roughly twice as high as shrimp beam trawlers and trammel netters. Finally, large beam trawlers have the highest GOP of all strategic groups, on average: twice as high as small beam trawlers and otter trawlers, and almost four times that of shrimp beam trawlers and trammel netters.

The relative landings per fishing hour (kg mixed fish/h) approximate the same rank order, although the ratios between the strategic groups change. Shrimp beam trawlers land the lowest amount of mixed fish in a fishing hour (only 32.1 kg/h). Small beam trawlers, otter trawlers and trammel netters land slightly more (approximately 40 kg/h). Finally, large beam trawlers land the most fish per fishing hour namely (75.36 kg/h). In contrast, the relative measures of financial performance tell a different story in which trammel netters play an interesting role. Although trammel netters perform low in gross operating profit, their gross operating profit per fishing hour (current €/h) is as high as that of the large beam trawlers (around 50 €/h), whereas their profit per landed kilogram mixed fish even outperforms every other strategic group (1.28 €/h versus approximately 0.70 €/h, respectively). The latter is mainly a result of the fact that they are the only strategic group that uses passive fishing techniques. These techniques are financially interesting when fuel prices are high, which is the case at the time of our dataset.

An examination of NOP (current €) and ROI (%) reveals a clear pattern. However, the many overlaps between the strategic groups in terms of significant and non-significant differences (indicated by the many superscripts per strategic group in Table 6) calls for prudence when interpreting these results. This is especially the case for both the otter trawlers and the trammel netters who suffer from rather small sample sizes and severe within-group variance related to NOP and ROI. Consequently, we can only draw limited conclusions. Nevertheless, it is certain that when taking the capital costs into account in the form of depreciations, shrimp beam trawlers are not profitable on average, as they have a negative NOP (−19,358 euro). Hence, this also results into a negative ROI (−1.29%), meaning that they are unable to even earn back their initially invested capital. Small beam trawlers and otter trawlers perform little better with average NOPs of 9782 and 1850 euro, respectively. As such, they are barely profitable and therefore their ROIs are marginally positive. Finally, the large beam trawlers and trammel netters perform best, with ROIs of roughly 1.5% and average NOPs of 58,243 and 11,469 euro, respectively. Nevertheless, their performance is still poor, as ROI is only considered to be good from 10% onwards (Tietze et al., 2005: 3).

Table 6
Performance indicators among the strategic groups of the Belgian fishing fleet (mean, for an average vessel of the strategic group), 1997–2006.

		Large beam trawler	Small beam trawler	Shrimp beam trawler	Otter trawler	Trammel netter
	N	573	265	379	86	26
Operational	Landings (kg mixed fish)	329,717[c]	143,281[b]	76,244[a]	158,703[b]	44,559[a]
	Landings/fishing hour (kg mixed fish/h)	75.36[c]	42.10[b]	32.10[a]	45.24[b]	40.04[b]
Financial	GOP (current €)	218,243[c]	109,782[b]	55,642[a]	101,850[b]	61,469[a]
	GOP/fishing hour (current €/h)	52.60[d]	30.65[b]	22.08[a]	29.63[a,b,c]	51.41[c,d]
	GOP/kg fish (current €/kg mixed fish)	0.69[a]	0.74[a]	0.67[a]	0.66[a]	1.28[b]
	NOP (current €)	58,243[c,d]	9782[b]	−19,358[a]	1850[a,b,d]	11,469[b,c]
Overall effectiveness	ROI (%)	1.46[c,d]	0.49[b]	−1.29[a]	0.09[a,b,d]	1.53[a,b,c]

Different superscripts (a–d) indicate significantly different average means using Kruskal–Wallis and Mann–Whitney *U* as post hoc test both with Bonferroni adjustment ($\alpha' = 0.005$ since $k = 5$).

3.3. Strategic group membership

Fig. 2 illustrates the evolution of the size of the strategic groups and total fleet between 1997 and 2006. It shows that large beam trawlers are the largest strategic group, except in 1997. From 1997 to 2000, the number of large beam trawlers increased from 52 to 65 vessels, an increase of 25%. After that time, it declined to 56 vessels in 2006 (a decrease of approximately 16%). The net change in fleet size between the years 1997 and 2006 is a slight net increase of four vessels or 7.1%. The small beam trawler fleet consisted of 27 vessels in 1997 and reached their maximum in 2002 with 32 vessels (+18.5%). However, during the subsequent years, this strategic group fell back to 23 vessels in 2006 (−39.1%). Consequently, there was a net loss of five vessels or 18.5% between the years 1997 and 2006. The strategic group of the shrimp beam trawlers has encountered a constant decline, except for 1999 where it gained four new group members compared to the previous year. This strategic group had 59 members in 1997 and declined to 29 in 2006 (−50.8%). The size of the otter trawler fleet declined the most. This strategic group had 13 vessels in 1997 but declined to three vessels in 2006 (−92.3%). The size of the trammel netter fleet increased from one vessel in 1997 to three in 2006.

These findings illustrate that the sizes of the strategic groups are not constant over time. In addition, it shows a recent trend of declining strategic group sizes, except for the strategic group of the trammel netters. Although the changes (especially the declines) in the size of strategic groups can be primarily explained by vessels exiting or entering the fishing industry (see infra, Table 7), they can also partly be explained by firm movements among strategic groups (i.e., shifts in group memberships or intra-industry shifts). However, Fig. 3 illustrates that more than 80% of the vessels did not shift strategic groups between the years 1997 and 2006. It shows

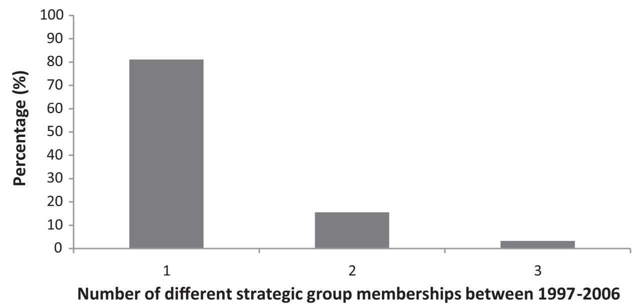

Fig. 3. Vessels with one or more strategic group memberships (%), 1997–2006.

that once a vessel had decided on its strategic position in the fishing industry, it stayed in 80% of the cases in that position for a significant amount of time (in this case, 10 years). In addition, only 15.6% and 3.3% of the vessels shifted between two or three strategic groups, respectively. Consequently, vessel movement across strategic groups is not important in explaining changes in the size of strategic groups in the case of the Belgian fishing fleet. Strategic groups are therefore very stable over time in the Belgian fishing fleet.

Fig. 4 illustrates there are significant differences across the strategic groups when examining firm movement. The large beam trawler fleet is the strategic group whose group members shift the least of all strategic groups. Only 4% of all vessels who have been a large beam trawler during the years 1997–2006 have had other group memberships between 1997 and 2006. Small beam trawlers had most firm movement, as only 35% of these vessels have never been a member of other strategic groups. As a result, 65% of all small beam trawlers have been a member of other strategic groups. How-

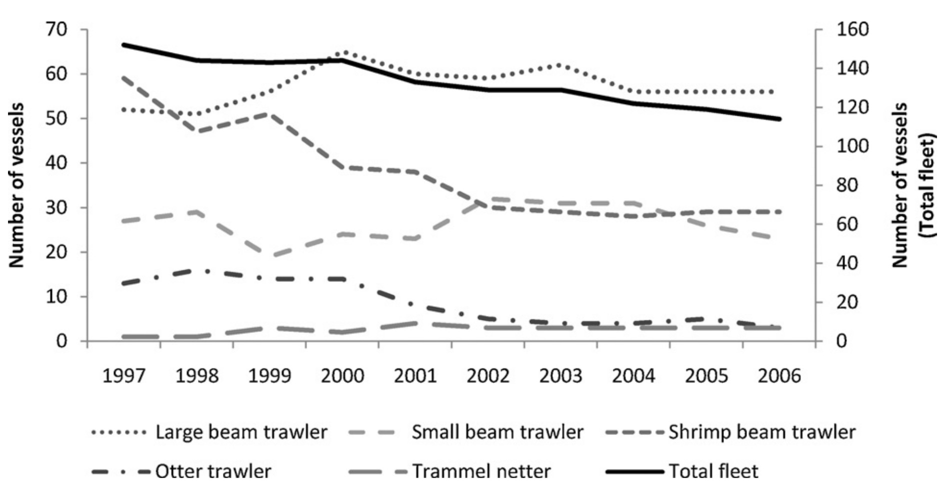

Fig. 2. Size of the strategic groups and total fleet (#vessels), 1997–2006.

Table 7
Yearly firm movement across strategic groups between adjacent years (#vessels, mean), 1997–2006 (cells containing no yearly firm movement are reported empty).

	To						
From	Large beam trawlers	Small beam trawlers	Shrimp beam trawler	Otter trawler	Trammel netter	Outside industry	Total
Large beam trawlers	52.89					4.56	57.44
(Row %)	(92%)					(8%)	(100%)
(Column %)	(91%)						
Small beam trawlers	0.33	22.67	1.78			2.11	26.89
(Row %)	(1%)	(84%)	(7%)			(8%)	(100%)
(Column %)	(1%)	(86%)	(5%)				
Shrimp beam trawlers		2.78	31.22	1.00	0.22	3.67	38.89
(Row %)		(7%)	(80%)	(3%)	(1%)	(9%)	(100%)
(Column %)		(11%)	(88%)	(12%)	(8%)		
Otter trawlers	0.11	0.44	0.89	6.89		0.89	9.22
(Row %)	(1%)	(5%)	(10%)	(75%)		(10%)	(100%)
(Column %)	(0%)	(2%)	(3%)	(85%)			
Trammel netters			0.11		2.33	0.11	2.56
(Row %)			(4%)		(91%)	(4%)	(100%)
(Column %)			(0%)		(84%)		
Outside industry	4.56	0.56	1.56	0.22	0.22		
(Column %)	(8%)	(2%)	(4%)	(3%)	(8%)		
Total	57.89	26.44	35.56	8.11	2.78		
(Column %)	(100%)	(100%)	(100%)	(100%)	(100%)		

ever, the strategic group of the shrimp beam trawlers has more stable memberships (approximately 60%) compared to the small beam trawlers. Like the small beam trawlers, the otter trawlers also show major fluctuations in group membership. Only 42% of the otter trawlers have never been a group member of other strategic groups during 1997–2006. Finally, 60% of the trammel netters have never shifted group membership between the years 1997 and 2006. As a result, this group, together with the shrimp beam trawlers, is the second most stable group in terms of group membership.

Finally, Table 7 illustrates the average yearly firm movement across strategic groups between pairs of adjacent years (i.e., 1997–1998, 1998–1999, . . ., 2005–2006). For the large beam trawler fleet, it is clear that they or (1) remain very loyal to their strategic group choice (on average, 92% of the cases), or (2) exit the fishing industry (on average, 8% of the cases). Consequently, there is no firm movement from large beam trawlers towards other strategic groups. When investigating firm movement from other strategic groups towards the large beam trawler fleet, one can observe that on average 91% of the total average firm movement towards large beam trawler fleet is from large beam trawlers from the previous year (so no actual firm movement), 8% is from outside the fishing industry, 1% is from small beam trawlers and 1% from otter trawlers. Small beam trawlers remain less loyal to their strategic choice (on average, 84% of the cases) when compared to the large beam trawler fleet (on average, 92% of the cases). They leave in on average 8% of the cases the fishing industry. In on average 1% and 7% of the cases they leave for the large beam trawler fleet or shrimp beam trawler fleet respectively. Firm movement towards the small beam trawler fleet is mainly from loyal small beam trawlers (86% of all cases). Shrimp beam trawlers and the otter trawlers move towards small beam trawlers in on average 7% and 5% of the cases respectively. Also interesting to notice is that on average only 2% of all firm movement towards the small beam trawler fleet is from new entrants to the fishing industry. Shrimp beam trawlers do not exit their strategic group in 80% of the cases on average. If they exit, they mainly opt to exit the fishing industry (on average, 9% of the cases) or move towards small beam trawlers (on average, 7%). However, there are also smaller migrations towards the otter trawler and trammel netter fleets (on average, 3% and 1% of the cases respectively). Firm movement towards the shrimp beam trawler fleet is on average for 88% accounted for by loyal shrimp beam trawler. The remaining movement towards this strategic group is made up by on average 5%, 3% and 4% from small beam trawlers, otter trawlers and new entrants from outside the fishing industry respectively. Next, otter trawlers are the least loyal among adjacent years of all five strategic groups since on average 75% of all firm movement is accounted to otter trawlers being loyal. Otter trawlers leave their strategic group, mainly and equally, through exiting the fishing industry or through movement towards the shrimp beam trawler fleet (both on average, 10% of the cases). However, they also move to a lower extent

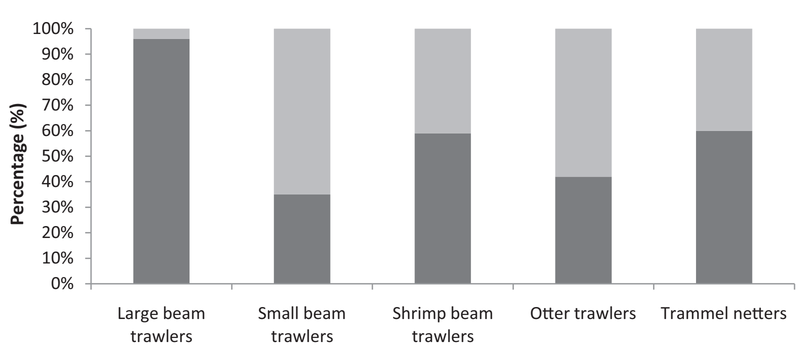

Fig. 4. Differences in the stability of group memberships across the strategic groups (%), 1997–2006.

towards large and small beam trawlers (on average, 1% and 5% of the cases respectively). Firm movement towards otter trawlers is in on average 85% of the cases from loyal otter trawlers. In on average 10% and 3% of all cases it is from shrimp beam trawlers either new entrants from outside the fishing industry respectively. There is no observed firm movement towards otter trawlers from the other three strategic groups. Lastly, trammel netters are like large beam trawlers very loyal since in on average 91% of the cases they stick to their strategic direction between pairs of adjacent years. If they do not remain loyal, they leave in on average 4% of the cases the fishing industry or they leave for the shrimp beam trawler fleet. Vessels entering the trammel netter fleet are in both 8% of the cases from the shrimp beam trawler fleet or from outside the industry. 84% of the total average firm movement towards trammel netters is explained by loyal trammel netters.

4. Discussion

Empirical strategic group research has primarily focused on defining strategic groups within single industries to examine whether performance persistently differs across these groups and affects overall industry performance (e.g., Cool and Schendel, 1987; Fiegenbaum and Thomas, 1993; Fombrun and Zajac, 1987; Frazier and Howell, 1983; Harrigan, 1985; Hatten and Schendel, 1977; Hawes and Crittenden, 1984). Additionally, research has also usually examined if strategic groups are subject to "changes" over time, such as whether group membership shifts, or if the number of strategic groups changes. The objectives of our study are in line with these central research questions in strategic group research. This study borrows the concept of strategic groups together with its theory from the field of strategic management and applies it to the case of the Belgian fishing fleet.

Our study discovers five strategic groups in the Belgian fishing fleet which rejects the first hypothesis, "all the vessels of the Belgian fishing fleet belong to the same strategic group". It also finds differences in the performance across most of these strategic groups, which rejects our second hypothesis, "all strategic groups perform the same". This finding not only assesses the criterion validity of the obtained cluster solution (i.e. its usefulness for the prediction of performance differences within the fishing fleet), it also contributes to the discussion in the strategic group research on the existence of a "group membership–performance link" (Barney and Hoskisson, 1990). Although strategic group research is still unable to consistently find this link (Cool and Schendel, 1988; Ketchen et al., 1997), this study illustrates that in the case of the Belgian fishing fleet the group memberships–performance link does persist.

Related to the third and fourth hypotheses on group membership and group loyalty, the results unveil that most vessels remain a member of their strategic group for many years. This confirms the third hypotheses, "Vessels do not move among strategic groups over time". This finding is in line with the results of previous studies (Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990; Fiegenbaum and Thomas, 1993; Oster, 1982) and the theory of the existence of mobility barriers between strategic groups that deter or inhibit the movement of a firm from one strategic group to another (Caves and Porter, 1977). However, not every strategic group enjoys the same level of group loyalty since significant differences are observed across the strategic groups concerning firm movement. This rejects the fourth hypothesis. Although it is definitely a topic for further research, a possible interpretation for this phenomenon is the theory of asymmetric mobility barriers (Caves and Porter, 1977; Harrigan, 1985; Hatten and Hatten, 1987) in combination with a firm's "isolating mechanisms" (Rumelt, 1984).

Asymmetric mobility barriers mean that not all mobility barriers are equally high between strategic groups. Consequently, some shifts between strategic groups are more easily made than others because they require an accumulation of one or more resources which is not too costly or risky. The results on the average yearly firm movement across strategic groups between pairs of adjacent years illustrated that small beam trawlers and shrimp beam trawlers often shift between these strategic groups. These shifts only require the purchase of a new fishing net and successful targeting of other species. Further inquiry also illustrated that there is often a "back-and-forth"-move between these strategic groups. This can be mainly explained by the fact that in some years small beam trawlers may have had caught a lot of shrimp during the shrimp season and therefore kept targeting them longer than usual. Consequently, cluster analysis allocated them in that year to the strategic group of shrimp beam trawlers instead of small beam trawlers. The inverse pattern exists in the strategic groups of the shrimp beam trawlers. Next, the results on the average yearly firm movement across strategic groups also showed that there is significant firm movement from otter trawlers to both the small beam trawler fleet and shrimp beam trawler fleet. In the first case this requires only the purchase of new fishing gear and being able to use it successfully. In the second case this requires the purchase of new fishing gear and being able to successfully target shrimp. The fact that otter trawler move towards two strategic groups show that they did not have a second best choice like the "small beam trawlers-shrimp beam trawler"-trade off. Additionally, "back-and-forth"-movement is not observed for the otter trawler fleet since small beam trawlers and shrimp beam trawlers do not or at least not that frequently move back to the otter trawler fleet. Hence, it seems that vessels which have made the shift towards the otter trawler fleet are satisfied with their new strategic direction. Finally, the results of average yearly firm movement across strategic groups illustrates that there are also marginal or absent potential firm movements. This can illustrate that certain shifts are (too) costly or risky. For instance: small beam trawlers whose ambition is to become a member of the large beam trawler group have to invest in a larger and more powerful engine. In addition, the engines will consume more fuel, which will result in higher operational costs. As a result, these small beam trawlers encounter much higher mobility barriers compared to the small beam trawlers who shift to operate as shrimp beam trawlers.

Isolating mechanisms is a second phenomenon that can block firm movement. It means that "individual firms are also constrained by their resource base and the legacy of past investments. These isolating mechanisms represent firm-specific commitments (i.e., resources) that restrict the individual firm's degrees of strategic freedom and thus may prevent a firm from switching from one strategy to another" (Leask and Parnell, 2005: 459). This is for instance the case for the current trammel netting fleet in Belgium. These vessels are often catamarans that have not the capability to tow fishing gear over the sea-bed. Hence, their past strategic decisions have isolated them from any form of beam- or otter trawling. This clearly limits their strategic freedom if the fishing environment would (al of a sudden) change significantly to their disadvantage.

Despite careful attention to reliability and validity in this study, important limitations remain. First of all, the validity of this study outside the Belgian fishing fleet is limited because it is an empirical "single industry/single country"-study. In future research on strategic groups in EU fisheries, researchers could include more than one country in their analysis. Furthermore, future research on strategic groups should also primarily focus on defining strategic groups across multiple countries and/or perhaps multiple (similar) industries. However, such studies would only become possible given a uniform methodology for defining strategic groups across (similar) industries and/or countries. A second limitation of this study may lie in its time horizon. Although 10 years is a reasonable timeframe, the authors believe that setting the timeframe at several decades would have identified more different strategic groups (e.g., large otter trawlers) and more group member shifts across strategic groups, as a vessel remains operational for much longer than 10 years. This expanded timeframe could perhaps even lead to identifying different resources as the sources of competitive advantages. However, expanding the time frame to decades may be impossible due to data limitations. A third limitation is the absence of the use of "stable strategic time periods (SSTP)" (i.e. time periods of strategic homogeneity with regard to competitive strategy behaviour) (Fiegenbaum et al., 1990; Fiegenbaum and Thomas, 1990, 1993) in our analysis in combination with the use of a fixed number of strategic groups over time. This mainly implies that our study assumes that the fishing environment in which Belgian fisheries has operated between 1997 and 2006 was stable over time (i.e. we assumed that the time between 1997 and 2006 was one SSTP). Hence, we ran one cluster analysis across the entire dataset of pooled vessel-year combinations instead of running separate cluster analyses for each of the SSTPs between 1997 and 2006. These two limitations and it underlying assumption are permitted since (1) the time horizon of this study is medium term; and (2) group structure has been found to be fairly stable and predictable over modest periods of time (Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990; Oster, 1982). A fourth limitation is the study's static analysis. Although strategic group research has primarily used different kinds of static analyses (e.g., regression models (Hatten and Schendel, 1977; Hatten et al., 1978; Newman, 1978; Porter, 1979), MANOVA's (Hawes and Crittenden, 1984), MANOVA's and regression models (Frazier and Howell, 1983), or ANOVA's and MANOVA's (Fiegenbaum and Thomas, 1993)), future studies should apply dynamic models in analysing group dynamics (e.g., agent-based models (Gilbert and Troitzch, 1999) or system dynamics (Forrester, 1961; Sterman, 2000)). A final limitation of this study may be the labelling of the strategic groups. Labelling each strategic group is a subjective process. This study opted to use the terminology and labels of existing sub fleet classifications where possible. This has the advantage that policymakers will recognize some of the strategic groups. However, it also led to the slightly forced labelling of one strategic group: "the shrimp beam trawlers". In this group, some vessels land only small amounts of shrimp but are very specialised towards some other target species. The label "specialised small beam trawlers" may have been more appropriate here. In addition, this inadequate label also resulted in a slightly counterintuitive outcome: the disappointing performance of shrimp beam trawlers compared to other strategic groups.

This study contributes directly to the fishing industry because it shows ship owners the different performance potentials for the different competitive strategies in the current industry. This allows them to reflect on current business and change strategic course if desired, based on performance indicators. If they are satisfied with their current strategic direction, ship owners can still compare their performance to the average performance of their group peers allowing them to evaluate how they are performing within their strategic group. However, the main contribution of this study lies in its value for fisheries management. The authors believe that strategic group theory contains (new) opportunities to reflect about fisheries management and its regulation. Strategic group theory offers fisheries management a strategically grounded theory for developing fishing fleet taxonomies. These taxonomies divide the fleet in strategic groups, each with a unique state in resource configuration and competitive strategy. Strategic group taxonomies have the potential of providing a solution to many of the current problems inherent to fleet segmentation (e.g., too complex, based on only one "clustering variable", not exhaustive, etc.) provided the link between strategic groups and fisheries externalities or market failures can be established. Moreover, Fiegenbaum et al. (1988: 21) state that "identifying the strategic dimensions that define strategic groups is a key issue in understanding how competitors formulate their strategies" and that "strategic groups help us understand which firms compete strongly with each other". Consequently, knowing these strategic differences between firms within the same industry is crucial when managing fisheries and implementing public policies (Oster, 1982: 376). As a result, policymakers and scientists should start defining strategic groups within fisheries and further test if they could be of further value to question, challenge, rethink or improve or (1) tremendously detailed taxonomies of sub fleets solely based on technical characteristics (i.e. fishing methods, gear modifications and mesh sizes) (EC, 2002) or (2) overly specified classification systems based on métiers (EC, 2008) which probably need simplification (i.e., aggregation of métiers in fleet segments) if they want to be workable in practice. Moreover, this strategic group approach shall result in a more strategic form of regulation. Regulation should in the future not only be focused on ensuring that there are no market failures and that externalities are limited. Regulation should also be focused on (1) affecting strategic groups' competitive advantages (i.e., mobility barriers), (2) affecting "isolating mechanisms" of firms, and (3) managing rivalry between strategic groups. This does not necessary implies that additional regulation needs to be put in place. Instead, the range of policy instruments should be rethought in the light of those efficiently affecting the sources of the mobility barriers between strategic groups, altering individual vessels or a strategic group's position within its strategic space. However, the question remains how and to what extent policy makers should manage mobility barriers, isolating mechanisms and rivalry. Policy makers can basically take three types of actions related to all three of them: (1) to increase, (2) to decrease or (3) to conserve them. Each of these actions will have an impact on industry profits, fish stocks, and the fisheries system as a whole. Consequently, further research will have to determine what these effects are. Questions like: "If we try to lower all mobility barriers, would this result in higher profits for the fishing industry as a whole? And what would be the effect on certain fish stocks?" stand central to this kind of future research.

In conclusion, the authors believe that the use of strategic groups can be a way towards simplifying the current Common Fisheries Policy of the European Union. But this study should only be seen as a first introduction of the concept of strategic groups to fisheries management science and fisheries science in general. Further research will be vital in convincing policymakers of the value of strategic groups to manage fishing fleets. For EU fisheries policy, a crucial step will be to shift the focus from a single country study to one incorporating many EU countries. In addition, research should also focus on the origin of the shifts between strategic groups. Future questions could be, "What are the internal or external causes driving vessels to move between strategic groups? And to what extent are such moves motivated by performance differences?"

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